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Comment On: NSF-2025-OGC-0001-0001
Request for Information: Development of a 2025 National Artificial Intelligence Research and Development Strategic Plan

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General Comment

In response to the National Science Foundation's Request for Information on the Development of a 2025 National Artificial Intelligence (AI) Research and Development (R&D) Strategic Plan, the University of Maryland is grateful for the opportunity to propose strategic AI R&D areas where the U.S. can accelerate innovation, enhance economic and national security, and maintain our status as a global leader in research and technology development. University-based research contributions to AI R&D are uniquely valuable to our national innovation capabilities, as academic researchers can develop new approaches and methodologies without the constraints of immediate commercial applications. The attached PDF document includes promising growth areas for AI R&D.

Attachments

NSF RFI on National AI R and D Strategic Plan - May 2025

Response to NSF RFI on 2025 National AI R&D Strategic Plan

In response to the National Science Foundation's [Request for Information on the Development of a 2025 National Artificial Intelligence \(AI\) Research and Development \(R&D\) Strategic Plan](#), the University of Maryland is grateful for the opportunity to propose strategic AI R&D areas where the U.S. can accelerate innovation, enhance economic and national security, and maintain our status as a global leader in research and technology development. University-based research contributions to AI R&D are uniquely valuable to our national innovation capabilities, as academic researchers can develop new approaches and methodologies without the constraints of immediate commercial applications. The following list includes promising growth areas for AI R&D:

Developing Human-Centered AI Applications to Build Trust:

Building AI technology that centers humans throughout the entire AI development lifecycle—from problem formulation through evaluation and accountability—is critically important to ensure that AI supports human flourishing. Integrating participatory design, technology, and governance of AI systems and technologies is fundamental to building trust in AI. Instrumentation and telemetry can help improve understanding of how AI is used and how effective and efficient human-centered AI applications are.

Advancing Human-AI Interaction:

AI research that advances productive human-AI interactions is essential, including improving question-answering abilities of AI systems to better emulate and/or complement human cognitive capabilities in problem-solving, as well as building AI applications that guide humans with instructions, highlighting potential errors and suggesting corrections. Developing trusted AI agents that effectively and accurately respect the authority delegated to them by people is critical to realizing the potential of AI to enhance daily life for American citizens. Establishing benchmarks for effectively "grading" AI and human competencies in ways that differentiate their strengths and tracking U.S. AI technology growth over the technology growth of other countries should be prioritized.

AI Research for Accelerating Scientific Discovery and Technological Breakthroughs:

AI also offers the potential to accelerate breakthrough discoveries in physics, astronomy, material design, biology, and neuroscience, among other areas, by augmenting traditional scientific methods. AI can address fundamental scientific questions, helping scientists generate new hypotheses, design experiments, and analyze data.

Improving AI Systems to Mirror the Capabilities of the Human Brain:

Research focused on advancing AI to mimic the natural neural capabilities of the human brain offers the potential to revolutionize AI systems by enabling them to spot early warning signs in everything from cancer to severe weather. Advancing AI by learning from the brain can result in the creation of a more adaptive and intuitive tool, capable of evolving. Ultimately, AI should be seen as a collaborator or teammate with distinctive competencies that enhance human capabilities.

AI for Medical Applications:

Leveraging AI for medical applications offers the potential to revolutionize health technologies. AI applications can be used to study emerging diseases and establish precision healthcare for patients can result in better diagnoses and treatments tailored to an individual's unique health needs. For example, poorly controlled diabetes, high blood pressure, risk of opioid overdose, and early kidney disease can be areas where AI-driven targeted interventions can be developed to prevent disease progression.

AI Research for National Security and Critical Infrastructure:

AI is a critically important tool for national security. Harnessing AI for language processing and enhancing communication and intelligence capabilities to enable more efficient data analysis and interpretation is vital for timely decision-making. Applying AI to address critical government applications, manage infrastructure, support supply chains, streamline the acquisition of new critical technologies, and facilitate data-driven decision-making can strengthen our national security operations.

Advancing AI Applications in Cybersecurity:

AI is extremely important for cybersecurity technology development. AI adds new threat surfaces to systems, innovation must be accelerated in system and system-of-system cybersecurity to account for the risk AI might add to existing systems and critical infrastructure. For example, developing safeguards against attacks on machine learning algorithms is critical for ensuring the safety of AI systems that learn from data and make decisions with minimal human programming. Attacks against these systems are an emerging security threat as AI is further applied to industrial settings, medicine, information analysis and other areas. Also, cybersecurity is critical for intellectual property (IP) protection. Universities like the University of Maryland are engines for developing American IP that the private sector depends upon, and protecting this IP is imperative.

AI Innovation to Revolutionize Learning and Advance the American Workforce:

AI offers the possibility of transforming education and achieving greater efficiency and effectiveness for all students by supporting interactive learning and evidence-based

interventions. Integrating AI technological advancements, data science, and educational policy can help advance workforce training across a variety of trades and professions as well as across different stages of the human learning trajectory, from early childhood to adult education. Introducing AI tools in learning environments will improve American classrooms and advance national workforce development at all stages, but it requires both teacher and student training.

Teaching AI and Promoting AI Literacy:

Another important area is teaching AI to advance AI literacy, helping people understand AI capabilities, foster critical thinking, and consider responsible use of AI applications. Helping students develop AI competency — and upskilling current professionals — will ensure that they are equipped with the knowledge and skills needed to adapt and succeed in the modern workplace.

AI for the Integration of Knowledge and Insights across Domains and Disciplines in Scientific Research:

AI systems can be developed to complement and augment the ability of researchers, policymakers, communicators, and citizens to make sense of large and diverse collections of relevant streams of information, including news, the scientific literature, and social media information. Scientific terminology and approaches can be siloed within individual fields, and are often not easily understood across different disciplines. AI can help address this barrier, providing pathways for improved knowledge sharing across domains.

Advancing AI Applications in Food and Natural Systems:

AI is uniquely structured to rapidly advance solutions for sustainable and resilient agriculture in regions facing shifting demographics and increased frequency of severe weather. User-inspired AI applications in food and natural systems will result in a paradigm shift in food production and processing that could make food safer and more secure. AI can optimize the use of water and other resources to help humans more effectively use natural resources.

Support for Community-Based Infrastructure to Fuel AI Health Innovation:

To achieve trustworthy AI for health innovation, communities can be involved in shaping and achieving the research agenda. Investing in community-based research hubs where AI is developed with—not just for—a variety of populations can help meet this goal. Extending AI R&D to support grassroots health organizations and community health centers as co-investigators, especially in implementation science, could be an effective approach.

AI and Survey Research and Development:

Integrating AI into survey development can significantly enhance efficiency and accuracy, as well as response analysis, insights, and conclusions. Large Language Models (LLMs) offer transformative potential in survey research, particularly with regard to survey design and the role of LLMs as qualitative interviewers, allowing in-depth information gathering through their human-like conversational ability. Potential applications include census, polling, and epidemiological surveying.